Passaic River Restoration Initiative: A New Model for Cleaning Up Our Nation's Contaminated Urban Rivers

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Abstract

Many urban rivers nationwide contain severely contaminated sediments that affect aquatic life and limit recreational and economic uses. At current rates of removal, it would take between 100 and 400 years to remove the problem by dredging, even if all discharges to surface water bodies in the U.S. were to be terminated immediately. In response to this situation, a new cooperative program to restore rivers affected by contaminated sediments is being undertaken in the Passaic River Basin, New Jersey. The approach involves an urban industrial river restoration project by the Corps of Engineers, working in conjunction with the Environmental Protection Agency and other appropriate federal, state and local agencies, through the standard civil works project development process. Under this urban river restoration approach, the Corps is conducting a cooperative project planning and development processes to identify and apply the most feasible technical solutions to achieve environmental restoration and economic revitalization in the Lower Passaic River Basin. With its long history of contamination, large number of dischargers, complex mix of contaminants, and problems with on-going pollution, the lower Passaic River in New Jersey is viewed as an excellent test of this new paradigm.

Introduction

Many urban rivers nationwide contain severely contaminated sediments that affect aquatic life and limit recreational and economic uses of the rivers. The most comprehensive assessment of chemical contaminants in river, lake, ocean and estuary bottoms conducted to date was undertaken by the U.S. Environmental Protection Agency in response to a congressional directive in the Water Resources Development Act of 1992. The resulting report, *The Incidence and Severity of Sediment Contamination in Surface Waters of the United States,* examined 1,372 (65%) of the 2,111 watersheds in the continental United States (1).

This screening-level assessment of sediment chemistry and related biological data identified 96 watersheds that contain "areas of probable concern" with regard to contaminated sediments. Adverse environmental conditions in these watersheds are caused by variety of sources, including urban runoff, municipal waste discharges, industrial effluents, and agricultural residues.

The magnitude of the contaminated sediment problem in the U.S. is striking. EPA estimates that more than 1.2 billion cubic yards of contaminated sediment exist nationwide. By way of comparison, between three and twelve million cubic yards of contaminated sediment (0.25% – 1.0% of the existing amount) are dredged annually, according to EPA. Thus, even if all discharges to surface water bodies in the U.S. were to be terminated immediately and permanently, it would take between 100 and 400 years

to remove the problem by dredging. Of course, the reality is that such discharges will not be stopped. And, since discharges contributing to contaminated sediments exceed current rates of removal, the problem never will be solved unless a new paradigm is found to deal with this problem.

Contaminated sediments exact an unquantified but large toll on human and ecological health across the Nation. Threats cited in EPA's *Contaminated Sediment Management Strategy* include possible juvenile neurological and IQ impairment from food chain poisoning, increased incidence of cancer, and long-term damage to aquatic ecosystems (2).

A study of 262 brownfield redevelopment case studies undertaken under sponsorship of the Institute for Water Resources, U.S. Army Corps of Engineers, found that the solution to urban river corridor water quality degradation problems is a key ingredient at 37 (14.1%) of the sites (3). When viewed in light of the 425,000 brownfield sites estimated to exist in the U.S. by the General Accounting Office (4), the potential contribution that a solution to the contaminated sentiment problem can make to the national brownfields redevelopment initiative becomes apparent.

Unfortunately, there exists no simple solution to contaminated sediment problems. According to a recent study of the problem undertaken by the National Research Council, challenges to managing contaminated sediments include an inadequate understanding of sediment physical, chemical and biological processes; a complex and inconsistent legal and regulatory framework; a highly charged political atmosphere surrounding the issue; and high costs and technical difficulties involved in sediment characterization, removal, containment and treatment (5).

While some contaminated sediment problem areas are being addressed under the Comprehensive Environmental Restoration, Compensation and Liability Act (CERCLA), and others are being handled by other authorities, most are not being addressed at the present time. At locations where solutions are being attempted, existing programs have not proven to be effective in restoring degraded urban rivers to quality standards, despite the fact that urban river restoration is critically important to many brownfield redevelopment efforts.

A New Approach

In response to this situation, the U.S. Army Corps of Engineers is undertaking a new cooperative program to restore rivers affected by contaminated sediments. This new approach is being implemented through the standard civil works project development process in conjunction with the Environmental Protection Agency and other appropriate federal, state and local agencies.

Under this urban river restoration concept, the Corps has begun a cooperative project planning and development processes, in conjunction with state and local agencies and

other stakeholders, to identify and apply the most feasible technical solutions to achieve environmental restoration and economic revitalization in the Passaic River corridor.

The new initiative has strong synergy with several current major federal initiatives, including the brownfields redevelopment initiative; the TMDL initiative; the natural resource damage assessment and restoration program; and new ecosystem restoration and protection, and aquatic ecosystem restoration authorities provided to the Corps in recent Water Resources Development Acts. With its long history of contamination, large number of dischargers, complex mix of contaminants, and problems with on-going pollution, the lower Passaic River in New Jersey is viewed as an excellent test of this new model that may have applicability nationwide.

The Lower Passaic River Basin

The Passaic River basin drains almost 935 square miles in northeastern New Jersey and southeastern New York. The lower part of the river (downstream of the Dundee Dam) flows through a very urbanized, highly industrial area. The 27.5 km reach below Dundee Dam is tidally influenced (6).

The lower Passaic River is located in the heartland of the U.S. industrial revolution that began in the late 19th century. As a result, the environmental and economic problems in the Passaic River Basin are extensive and complex. Since the beginning of the industrial revolution, literally hundreds of chemical, paint, and pigment manufacturing plants, petroleum refineries, and other large industrial facilities have been located along the banks of the Passaic (7). Industrial effluents from these facilities over the years has caused severe contamination of the sediments underlying the Passaic River. While many of these facilities have closed, currently 13 petroleum refineries and six chemical manufacturing plants are still operating (6). High concentrations of dioxins, mercury, lead, polychlorinated biphenyls and other chemicals characterize this highly degraded river system (8).

Not only is there extensive contamination of the river bottom, more than a century of heavy industrial use of the area has resulted in extensive shoreline impacts, including an almost complete loss of tidal and freshwater wetland habitat through bulkheading and other anthropogenic structural changes (9). Impacts to fish and shellfish have been extensive, as have impacts to birds and mammal populations. In addition, a number of historical tributaries to the Passaic have been converted to storm sewer drains or filled in and freshwater inflows have been reduced dramatically. Human uses such as fishing, rowing, boating, swimming, picnicking and wildlife observation have been severely degraded (10). Other dimensions of complexity include pathogenic microbial contamination, floatable debris, excessive levels of waterborne nutrients, and non-point source discharges (6).

Another dimension of complexity, in addition to the extensive contamination and degradation of ecosystem and recreational values that has occurred, involves the large number of stakeholder groups having interests in the watershed, including municipalities,

environmental organizations, industries and other entities. Environmental justice is yet another issue in the Passaic Basin, where minorities and economically disadvantaged people tend to be exposed disproportionately to contaminants (11).

Need for a Watershed Approach

This level of complexity makes a comprehensive watershed approach to the solution of the multifaceted problems essential to successful economic revitalization and environmental restoration. The term "watershed approach" refers to an integrated perspective in water resources planning that provides a framework for integrating economic, natural and social considerations that share the same geographic space. This framework facilitates coordination of public and private sector efforts to address the highest priority problems within hydrologically-defined geographic areas such as the Passaic River Basin.

As articulated in EPA's *Watershed Approach Framework*, in the watershed approach:

> …managers from all levels of government can better understand the cumulative impacts of various human activities and determine the most critical problems within each watershed. Using this information to set priorities for action allows public and private managers from all levels to allocate limited financial and human resources to address the most critical needs. Establishing environmental indicators helps guide activities toward solving those high priority problems and measuring success in making real world improvements rather than simply fulfilling programmatic requirements (12).

Important elements of the watershed approach include assessment of natural, social and economic resources, interdisciplinary identification of priority problems, identification of goals and objectives, facilitation of high levels of stakeholder involvement, development integrated solutions that make use of the expertise of multiple agencies, utilization of management techniques based on sound science, and measurement of success through monitoring and other types of data collection. Under the watershed approach, appropriate agencies compare lists of high priority areas, meet with each other and with other stakeholders, and look for opportunities to leverage finite resources to meet common goals (13).

It is precisely to this type of challenge that the Corps of Engineers, with its extensive experience in comprehensive watershed planning and multidisciplinary capabilities, is well suited to address. Under recently enacted legislative authorities, the Corps now has authority to undertake single-purpose ecosystem restoration initiatives or multiple purpose projects that include ecosystem restoration as a purpose. Recently promulgated Corps regulations provide that:

> Ecosystem Restoration is one of the primary missions of the Civil Works program. The purpose of Civil Works ecosystem restoration activities is

> to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Ecosystem restoration efforts will involve a comprehensive examination of the problems contributing to the system degradation, and the development of alternative means of their solution (14).

A variety of recently enacted authorities enable the Corps to undertake all aspects of ecosystem protection and restoration studies and project implementation (15). These broad statutory authorities, combined with the Corps' state-of-the-art expertise with recently developed analytical tools relevant to watershed-based planning (such as GIS, GPS, powerful electronic computational hardware and software, and the Internet), make conversion of the theoretical watershed approach concept into specific project and programmatic activities a realistic expectation.

In order to facilitate the new roles envisioned in these new authorities, the Corps in April 2000 established a new planning objective for its civil works planning studies. The new objective, the National Ecosystem Restoration (NER) objective, is intended to increase the quantity and quality of ecosystem resources. Under new Corps guidance, single purpose ecosystem restoration plans may be formulated and evaluated in terms of their contributions to increases in ecosystem values. According to the language of the Corps' civil works planning guidance, measures of ecosystem restoration projects are not to be based on monetary units, but are to be

> …based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in physical units or indexes (not monetary units). These net changes are measured in the planning area and in the rest of the Nation (16).

The Passaic River Environmental Restoration Initiative

The first steps to implement this new approach to urban river restoration recently began in the Lower Passaic River, New Jersey. On April 17, 2000, the Transportation and Infrastructure Committee of the U.S. House of Representatives passed a resolution authorizing the Corps of Engineers to conduct a reconnaissance-level investigation entitled the *Passaic River Environmental Restoration Study* (17).

It is expected that the restoration project for the Passaic River will be planned and designed by the Corps using the agency's standard cooperative process for civil works project development involving other appropriate federal agencies, state and local agencies, and other public and private entities in the region. Under this process, the results of the project development process will be incorporated in a report to Congress from the Chief of Engineers. The report will include recommendations for project implementation and apportionment of funding among the federal government and non-federal sponsors, a completed EIS, and the views of concerned agencies. Study and implementation costs would be shared with non-federal sponsors, with entities

responsible for contamination paying fair shares. Project implementation will require authorization by Congress.

While the precise geographic area of the study has not yet been identified by the Corps, it is expected to include the lower 17 miles of the Passaic River from Dundee Dam to Newark Bay, and may include some of the upper Passaic watershed and possibly a part of Newark Bay. Specific actions to be undertaken will be developed by the Corps through its cooperative planning process. While these have not yet been identified, they could include project actions that will:

- Preserve and restore Passaic River water quality, sediments and watershed drainage areas, and possibly nearby wetlands in the upper Newark Bay.
- Protect river biota from contact with concentrations of multiple chemicals in the river sediments to help restore aquatic habitat.
- Raise submerged, unvegetated mudflats in the Passaic to create vegetated shallows (similar to pre-bulkhead conditions) that provide habitat value.
- Incorporate restored vegetated shallows into riverfront developments for recreational, municipal and commercial uses.
- Enhance degraded wetlands in the adjacent river systems to nurture expanded bird and fish populations.
- Reduce and control pollutants now entering the river from storm water runoff, outfalls, and atmospheric deposition to assist with restoration and to maintain the restored habitat.

The Lower Passaic River represents an excellent opportunity to test the civil works approach to cleaning up urban river corridors for a number of reasons. The complexity of the situation, as described above, demands a comprehensive, watershed-based to the problem. Site-specific solutions undertaken in the absence of an overall regional solution are doomed to failure no matter how well they may be designed and funded. Application of the Corps' experience and expertise in comprehensive watershed planning not only represents a promising solution to the problems of the Passaic, but also should provide an excellent real-world test of this new approach.

Although the complexity of the situation may be intimating, a great deal of information collection and stakeholder team building already has occurred in the Basin. Considerable work in the Passaic Basin, for example, has been performed by the New York-New Jersey Harbor Estuary Program (18). The Corps of Engineers itself recently reviewed the lower Passaic as part of its related Hudson-Raritan Estuary Environmental Restoration Study (19). In addition, private companies located in the basin have invested over $27 million in relevant research studies on the River in recent years, providing a strong analytical foundation for identifying and evaluating corrective measures.

In addition to these reasons, the Passaic River Environmental Restoration Study offers considerable synergy with other related efforts, such as the Urban Initiatives and the Community Based Environmental Protection goals of the EPA Region II Strategic Plan (20), and the EPA Brownfields Economic Redevelopment Initiative. Restoration of the Passaic River also may be instrumental to the success of such Brownfields Assessment

Demonstration Pilots as those in Paterson, Newark, Jersey City, Middlesex County, Hackensack Meadowlands, and Hudson County, New Jersey (21, 22, 23, 24, 25, 26).

Conclusion

Since publication of the landmark National Research Council report *Contaminated Marine Sediments: Assessment and Remediation* in 1989 (27), much has been learned about how to address this difficult problem. One of those learning points is that remedial technologies alone will not solve the problem. Solutions must consider aspects of source reduction, natural attenuation, *in-situ* containment and treatment, dredging, *ex-situ* treatment and other technological and institutional tools. All of these solution components must be considered in the context of appropriate human health and ecological risk considerations, benefit-cost considerations, and a host of other relevant factors.

With many stakeholders involved in the problem, consensus building among such parties also is essential to success. It is in this environment that the public works approach described herein clearly is a better model than approaches that rely on litigation. To reach solutions that result in the dedication of limited resources to real solutions rather than confrontation and conflict, nonadversarial processes are needed.

While cynicism from past frustrations may cause some to doubt the veracity of that statement, there are emerging at the present time several examples of apparently successful initiatives where substantive results, not endless process, are beginning to characterize cooperative partnerships. These include those in the Ashtabula River Basin, Ohio (28); Grand Calumet River Basin, Indiana (29); and others the in the Great Lakes region (30).

Building upon the lessons learned from these and other success stories is the goal of the Urban River Restoration Initiative. Hopefully, the Passaic River Restoration Initiative will prove to be the first step in moving away from a confrontational and potentially litigious situation toward a timely and comprehensive solution.

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